

# METHOD AND APPARATUS FOR AUTOMATED TRADING OF EQUITY SECURITIES USING A REAL TIME DATA ANALYSIS

## Technical Field

The present invention relates generally to automated systems for trading securities, and more specifically to an apparatus and method for automatically buying and selling equity securities based on market trends in response to pre-established decision models for the particular security.

## Background

5 A group of investors called day traders typically trade securities throughout the trading day. Day trading may be a hobby or rise to the level of a career. Unlike long term investors, day traders seek to capitalize on incremental trends in the price of securities throughout the trading day.

10 Day trading involves careful monitoring of a security and deciding whether to buy or sell based on intraday movements of the price and the trend of the security. Successful day trading depends on the ability to recognize a trend and the market momentum therein, timely execution of a buy or sell order, and a determination of when to forego a transaction.

15 There are different methods of day trading. One popular method is to track and trade highly volatile securities by attempting to buy when the security price is moving up or sell short when the security price is moving down. Various other sources of information besides price, such as volume, are often considered in deciding to enter into a transaction. Technical analysis of stock prices tell us that prices tend to move in trends, volume of traded  
20 securities corresponds with the trends, and a trend once established has momentum and tends to continue in force.





## Summary of the Invention

It is therefore one object of the invention to automatically buy, sell or sell short equity securities. It is a further object of the invention to quickly identify and react to trends or momentum in price movement for a security. Another object of the invention is to provide a system that both buys  
5 securities on the identification of a trend and sells securities automatically when the end of the trend is determined.

The present invention provides a method for buying and selling securities based on volatility and liquidity rather than commonly used stock fundamentals. In one aspect of the invention, a method for trading a security  
10 comprises the steps: formulating a decision model for the security; monitoring real-time market data; in response to the market data for the security and the decision model, automatically generating a transaction order; and transmitting the transaction order to a market computer.

One feature of the invention is that it allows the system operator  
15 to develop decision models. The decision models are not limited to variations of traditional technical analysis but instead can include novel analysis of data.

Another feature of the invention is that after an order is placed, the transaction may be monitored until execution. Until the transaction has been executed the decision model is monitored to determine whether to cancel  
20 the order.

A further feature is related to how a transaction is reversed once initiated. For example if a security is bought it can be sold through a decision model to sell or through a floating stop loss process.

In a further aspect of the invention, an automated securities  
25 trading system comprises a computer for formulating a decision model for the security. The computer is coupled to a network and receives real-time market

data. The computer automatically generates a transaction order in response to the market data based upon the decision model. The computer places the order.

One advantage of the invention is that if the system is used to monitor multiple securities, different decision models may be used for each.

- 5 Another advantage of the invention is that both buy and sell orders may be automatically executed by the system so that the orders are processed quickly to take advantage of price trends and momentum in the market as desired by day traders.

- 10 A further feature and advantage of the invention is that it may monitor real-time data and make decisions to buy or sell on a moment by moment basis. Several securities may be concurrently monitored through the decision models and transacted on a moment by moment basis.

- 15 Other objects and features of the present invention will become apparent when viewed in light of the detailed description of the preferred embodiment when taken in conjunction with the attached drawings and appended claims.

### **Brief Description Of The Drawings**

Figure 1 is a block diagrammatic view of a trading system according to the present invention.

- 20 Figure 2 is a high level system flow chart according to the present invention.

Figure 3 is a block diagram of data entry for the system according to the present invention.

Figure 4 is a flow chart for data input validation according to the present invention.

Figure 5 is a data and analysis decision flow chart according to the present invention.

Figure 6 is a decision point flow chart according to the present invention.

5                    Figure 7 is a transaction portion of a flow chart.

Figure 8 is an order preparation flow chart according to the present invention.

Figure 9 is an order execution preference chart according to the present invention.

10                  Figure 10 is a floating stop loss flow chart according to the present invention.

Figure 11 is a block diagrammatic view of an alternative embodiment of a trading system suitable for an on-line brokerage system.

### **Description Of The Preferred Embodiment**

15                  In the following figures like reference numerals are used to identify identical components in the various views. The following example is meant to be illustrative of a preferred method for implementing the automated trading securities system. However, those skilled in the art will recognize various alternative embodiments. For example, various decision models using various security or market data may be implemented.

20                  Referring now to Figure 1, an automated securities trading system 10 is illustrated. The automated trading system 10 has a personal computer (PC) 12 that is coupled to a network 14. Network 14 is coupled to a data source computer 16 and a market computer 18. The automated trading system 10 may also be remotely accessed through the network 14 by another  
25                  computer including a PC, hand held computer or a laptop computer 20.

Personal computer 12 is the most likely implementation of the present invention. However, other computing systems such as mainframes or minicomputers may also be used.

Personal computer 12 has a central processing unit (CPU) 24  
5 with memory 26. Memory 26 includes: random access memory (RAM); read only memory (ROM); flash or cache memory; a hard drive; and other data storage devices. Various data and a program for operating the present invention may reside in memory 26. CPU 24 has an interface 28 that is used to couple personal computer 12 to network 14. Various operating systems known to those  
10 skilled in the art may be used to operate personal computer 12. CPU 24 operates the software in conjunction with input devices such as a keyboard 30 and a mouse 32. Various data are displayed on a monitor 34. A printer 36 coupled to computer 12 is used to print displayed information and reports, from computer 12.

15 Network 14 is illustrated as hard wire connections between computer 12, data source 16 and market computer 18. Network 14 may, for example, be the Internet, or other network known to those skilled in the art. Interface 28 represents the connection to the network 14. Interface 28 may include but is not limited to a dial up modem, a cable modem, an ISDN line, a  
20 DSL line, a T1 line, or various other data lines and connectors known to those skilled in the art. Interface 28 may also include but is not limited to: wireless connections such as through satellites; high data rate wireless technology (HDR); or wireless phone networks.

Although illustrated as a single wide area network (WAN), the  
25 present invention may be implemented using several networks including a local area network (LAN). For example, both a WAN and a LAN may be used. For a LAN, a client/server network may be used having various numbers of client workstations connected thereto. The client/server network may be coupled to a WAN such as the Internet.







### 1. Number of levels of decision

A "level" refers to a separate grouping of components in the decision process. There must be at least one level and there may be several but in most applications only a few will be appropriate. The user enters a number  
5 of levels of decision from 1 to n.

For example one level may be selected with two components therein. Alternatively, four levels can be used with the first two using a single component and the next two using three and four components respectively. Nearly an unlimited number of combinations are available.

10 In the decision process a level will return a true or false value. A level returns a true or false value depending on whether the components have reached their decision points or range.

### 2. Relationship of the levels

The relationship between levels is a decision process as it relates  
15 to the levels. In general, a Boolean operation such as AND, OR, NOT will be used to compare the levels for making a decision. For example a decision model could have two levels with the following relationship: Level1 <AND> Level2. An alternative model could employ three levels with the following relationship: (Level1 <OR> Level2) <NOT> Level3. The user will have  
20 virtually unlimited discretion in the relationship of levels.

### 3. Components and databases

A "component" can be an element of data or an assigned function of data for a security, or market in general. With few exceptions the security data of interest is dynamic and available in real-time. Security data  
25 includes but is not limited to its: price; volume; bids; asks; spread; number of shares at each price level of bid; number of shares at each price level of ask;

time and sales; actions of market makers or specialists. Market data includes but is not limited to the following: NASDAQ volume or level; S&P futures volume or level; and Dow volume or level. There can be more than one function of a certain data type.

5                   For example, a component may be a function of volume traded for a security. Another component could be a function of how close the current price is to the inside bid or ask. A third component may be a function of the S&P futures. A fourth component may be based on tracking the activities of market makers. One of several ways this may be done is to assign a value to  
10 each of the finite number of market makers. A component may then be developed to track the activities of market makers including their offers or bids. The group of components available is only limited by the data accessible for a specific security or market.

                  A component can also be a function of historical data retrieved  
15 from a database for a security. Component databases 56, 58, 60 illustrate the databases that can be established for creating a source for component data. To create a component database, the user defines the data or function of data that is placed in the database. Any of the available security data that can be incorporated into a component may be placed in a component database. For  
20 example, a component could relate to the volume of shares traded and number of trades made at a specific price level. This type of component database may be used to identify support and resistance levels. A component may then be established to anticipate buying or selling pressure based on the database for how actively the security was traded in the past as the security approached a  
25 certain price level.

                  As illustrated, several component databases 58, 59 and 60 can be established for each level in the decision model. A virtually unlimited number of component databases can be established for each separate decision model.

In a preferred embodiment, a selection from an offering of the most commonly used components and component databases may be offered. Other components or functions of data may be customized.

#### 4. Relationship of components

- 5           There are several ways of defining a relationship between the components on each level. These include but are not limited to the following: 1. weighted data summation; 2. interaction or intersection; and, 3. singular values.

Each level can combine more than one component. In the intersection or interaction relationship the components may have a relationship  
10   that allows them to be combined to produce a net result. For example, one component may be a moving average of price for the preceding thirty ticks of data. Another component may be a moving average of price for the preceding ten ticks. A relationship may then be established where if one moving average crosses the other, then the condition (buy, sell, etc.) for the level has been met.

- 15           In the weighted data format the components are assigned equations that gives weight to the data. For example, one level could have three components. The first component may be a measure of volume. The second component may be a measure of price change. The third component may be a measure of how close the price is to the inside bid or ask. A relationship may  
20   then be established where the volume component is 20 % of the total, the measure of price change may be 30% of the total, and the spread 50% of the total. This means no matter how high the volume goes it can only contribute 20% to the total deciding factor.

- A significant value of this method is that it allows a combining  
25   of data that does not easily lend itself to comparison. It also allows for creating a sliding scale for each component that when combined produces a sliding scale of the total where no one component exclusively controls the net result.

## 5. Equations or formulas

Each component may be assigned an equation that works as a function of security data. The assigned equation serves more than one purpose. First, the equation may be a function of the data that gives it meaning. Second, the equation in the weighted data relationship may establish a continuum between low and high values. Third, in the weighted data format it may be used to give a weight to the data that can then be combined with other weighted data to give a combined result.

The user may be given options of equations for a component as part of the component selection process. Alternatively, a customized equation may be entered.

## 6. Decision points

A decision point refers to the moment data entered into a component reaches a predetermined level that satisfies the users criteria, in that component, for making the decision to buy, sell, sell short or buy to cover. A decision point may be a number, range of numbers or interaction between functions. For example a decision point may be when the price of a security increases by 1/8 point. It may also be when the average volume falls within a certain range. In addition a decision point could be when two different trailing averages intersect. The user has wide discretion in the definition of decision points.

As illustrated in block 62 information will be requested for input to system database 52. Block 62 may prompt the user for various pieces of data with respect to the overall system. For example, block 62 may prompt the user for system circuit breaker, brokerage and account information, the access method to the brokerage or to the exchange, the access method to the real-time data for securities, and any other system information.

Other information about the total number of shares that the system should buy or sell short may be used. It also tells the system how many shares should be bought or sold in a single transaction.

5 In block 54 information about holding periods, circuit breakers, exchange preferences and additional data will also be requested. Holding period refers to issues such as whether to hold a security overnight or have a mandatory sell at the end of the day.

10 Circuit breakers refer generally to trigger points that require a halt in part or all trading. An example may be when the system executes too many trades in a given time period. Another example of a circuit breaker is when the system achieves a level of draw down (loss of capital) that is not acceptable. Several circuit breakers may be offered.

15 Exchange preferences refer to user defined preferences for the particular exchange to use and the type of order to execute. For example all trading could be limited to one ECN such as ISLAND or spread around to several. In addition the order to buy could be always at the market or at the inside bid. Several options will be available.

20 As illustrated in block 62 there are several areas of information requested including: system circuit breakers; brokerage and account information; access method to brokerage; access method to real-time data; and, additional information.

25 System circuit breakers apply similar types of consideration as the circuit breakers for specific securities as discussed above. An example could be the maximum amount of draw down for the system including all securities being traded. Another example of a circuit breaker may be an event such as the markets shutting down. Several circuit breakers will be offered.







variations of a decision model. Step 638 illustrates Level 1 of the decision model. As discussed in reference to Figure 3 there can be one or several levels in the decision model. Steps 639 and 640 illustrate the possible addition of Level 2 and Level 3. Step 638 illustrates a weighted data summation format for the components in Level 1. This is but one of the several options for defining the relationship between the components for Level 1.

As illustrated in step 638, for Level 1 to be TRUE requires that the sum of the weighted data be greater than or equal to its decision level. An example of process 638 is as follows:

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If  $\sum_{i=1}^n f(\text{Comp}_i) \geq \text{DPoint1}$  then Level1 is TRUE

In this example  $f(\text{Comp}_1)$  represents a function of security data for Component 1. Additional functions of security data for components are represented by  $f(\text{Comp}_n)$ . The decision point for Level1 is represented by the variable DPoint1.

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As illustrated in process 639, for Level2 to be TRUE requires that there be intersection or interaction between the components. An example of process 639 is as follows:

If  $f(\text{Comp}_1) \cap f(\text{Comp}_2)$  then Level 2 is TRUE

20

In this example the functions of Component 1 and Component 2 are compared. One example may be when moving average of data is compared to another moving average.

As illustrated in process 640, for Level 3 to be TRUE requires that a component reach a specific value. An example of process 640 is as follows:

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If  $f(\text{Comp}_1) = \text{DPoint3}$  then Level3 is TRUE

The above examples are illustrative of the different types of relationships available for each level of a decision model. There are unlimited variations as to the number of Levels in a decision model and the number and type of components at each level. The above example illustrates one of many options available.

Step 641 represents the final step of the decision model where the results of the separate levels are combined in an IF ... THEN Boolean logic type operation. If the result of operation 641 is true then the system will proceed to step 527 where the system will proceed to prepare and submit a buy order for the security. For example, if there are three levels and the relationship in step 641 is represented as Level1 <AND> Level2 <NOT> Level3 then for a buy decision to be made requires that both Level1 and Level2 have reached their decision point and Level3 has not reached its decision point. If this occurs then the decision model will reach a buy decision.

Referring now to Figure 7, the logic that determines the appropriateness of a transaction for steps 531 and 533 is illustrated. Figure 7 illustrates the logic in the event of a buy decision as a result of process 526. Similar logic would apply in the event of a sell decision, sell short decision, and buy to cover decision. In step 742, if the security is already owned and the total to buy is not yet reached, then step 743 is executed. If the maximum number of transactions has not been reached, then step 744 is executed. If an operator defined level of draw down has not been reached, step 745 is executed if appropriate. In optional step 745, additional conditions may be required to be met to determine whether or not the transaction is appropriate. If all of the above are true, then step 533 indicates an appropriate transaction is reached. If in steps 742 through 745 the logic is no, then a transaction will not be entered for the particular security.

Referring now to Figure 8, the process for determining the best type of transaction from steps 535 is illustrated. In step 846, the best stock exchange is determined based on user preferences and the liquidity of the

exchange for the security is determined. For example, one ECN may be desirable over another due to transaction costs or offering a better bid price. In step 847, the best method for order execution or as modified by user preferences may be determined. Step 847 looks to the price momentum, availability of  
5 shares and activities of market makers in determining the best method for order execution. In addition, step 847 will formulate an order that complies with established order rules for the exchange and order type to be used. Part of the information for steps 846 and 847 may be input from a database of security data that includes the preferences as pre-defined.

10 Referring now to Figure 9, an example of the logic in step 847 above that may apply to determining the type of order based on order type and price momentum. A chart illustrates various market momentums and buy, sell or sell short orders. Various order types include: bid which is either high or low; an offer which can be either high or low; a small order execution system  
15 (SOES) order; and, a preference order to a specific market maker. An example of a determination of what type of order to be executed is illustrated. For example, for a buy order, depending on the market momentum, that is a momentum increasing, decreasing or staying the same, a bid may be processed high or low, respectively. A preference to a specific market maker may be bid  
20 high. If the momentum is decreasing, a bid between the spread may be formed and if the momentum is flat a bid between the spread may be formed. Also, if the momentum is increasing or staying the same, a SOES order may be placed.

If a sell order is required and the momentum is increasing, decreasing or staying the same, an offer high, an offer low, or an offer high may  
25 be formed respectively. Alternatively, an offer between the spread, an offer preference low, or an offer between the spread may be formed. Also, a SOES order may be implemented if the momentum is decreasing or staying flat.

If a sell short order is determined and the momentum is increasing, decreasing or staying the same, an offer high or an SOES order on  
30 an uptick may be performed. Alternatively, an offer between the spread and an

offer low on an uptick may be generated. If the price momentum is falling or flat an offer at a predetermined level above the current price may be offered on a downtick. For example, an offer of 1/16 above the price may be executed.

Referring now to Figure 10, a floating stop loss may also be used to determine when to sell or buy to cover a particular security. The floating stop loss illustrated in Figure 10 is different from that of a traditional stop loss. A floating stop loss is a feature of the instant invention's constant monitoring of the market for the security. Rather than the traditional method where a stop loss order for a specific amount is sent to the broker, a floating stop loss is accomplished when the system determines to exit the transaction and immediately sends an order for execution. Another distinct advantage of the floating stop loss is that it can follow the advance of a security and exit at the moment the stock turns down. A trading method can be developed where a security is bought according to a buy decision model and sold based on the floating stop loss rather than a sell model.

Step 1049 illustrates the basic concept of the floating stop loss when the security is owned. HPrice is a variable for the highest price for the security from the time of its purchase. CPrice is a variable for the security current price. BStop is a variable for the stop loss amount that the current price can differ from the highest price before requiring a sell order. In a floating stop loss BStop can be fixed at an amount such as 1/16th point and 1/4th point. In a dynamic floating stop loss BStop may be set to increase or decrease based on the continued increase in the security price. For example, BStop can be set to increase 1/16th point for every point increase in price.

Step 1050 illustrates a floating stop loss for a security sold short. In this step LPrice is a variable for the lowest price for the security from the time that it was sold short. CPrice is a variable for the security current price. SStop is the variable for the stop loss amount. As in step 1049, SStop can be fixed at a specific amount for a floating stop loss or variable as the price decreases for a dynamic floating stop loss.

In step 1049 or step 1050 if the logic is no, step 1051 is executed. In step 1051, if there is no other reason to reverse the transaction then the logic loops back to step 1049 or step 1050 for further checking. Concurrent or parallel to this process the decision models continue to be monitored to  
5 determine if they dictate a reversal of the transaction. In step 1049 or step 1050 if the logic is yes, then step 534 is performed.

Referring now to Figure 11, an embodiment of the invention is illustrated. The present embodiment is suitable as an option for traders using a common source such as an Internet brokerage 1105. Internet brokerage 1105  
10 has as resident on its computers' programs to implement the methods of the instant invention. Internet brokerage 1105 receives its market data from data source computers 1101 and connects to market computers 1103. Computers 1101 and 1103 may be implemented on the same computer system. Internet brokerage 1105 may include one or more mainframe computers or  
15 minicomputers with assorted microcomputers connected.

Servers 1107, 1109, 1111 represent a plurality of servers on the Internet connecting the Internet brokerage 1105 to the client computers 1113, 1115, 1117, 1119, 1121, and 1123. Client computers 1113, 1115, 1117, 1119, 1121, and 1123 may be of the type as described above. The client computers  
20 may also be "dumb" terminals such as a WebTV® device. Through their client computers the system users will be able to establish the parameters of the trading as discussed above. However, in this embodiment most, if not all, of the processing of the decision models may take place at the Internet brokerage computers 1105. Information about transactions will be displayed at the client  
25 computers. One advantage to such a system is that because trades are automatically executed, one less link, i.e., to the end user and back, during execution is performed. Therefore, any time associated with that connection is eliminated when executing a trade. Because market momentum may be rapid, timely execution of trades may reduce cost and increase the overall profits of  
30 the transaction.

In operation, a predetermined number of securities are identified to the system. A decision model for each of the securities is determined. Real-time market data is monitored as well as information from the databases. In response to the market data for the security and the decision model, a  
5 transaction order is automatically generated. The system automatically transmits the transaction order to the market computer. During the process and before execution of the order, the order is continually monitored to determine if it is appropriate. If the transaction at any time before execution is determined to be inappropriate, the order may be canceled. In addition, the system may be run  
10 in a training mode allowing the decision models to be tested prior to actual implementation and actual trading.

While particular embodiments of the invention have been shown and described, numerous variations and alternate embodiments will occur to those skilled in the art. Accordingly, it is intended that the invention be limited  
15 only in terms of the appended claims.